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ABSTRACT

This document describes an empirical study on the patterns of teacher behavior and a comparison of student outcomes from two settings where different programs (types of curricula) were used. The two psychological positions identified within the curricula were stated to have been operationalized in the two programs developed for the elementary school, Elementary Science Study (ESS) and Science - A Process Approach (SAPA). The former reflects the cognitive restructuring approach and the latter, the behavioral approach. The paper presents briefly the procedural factors of the research to include instruments used and a brief report of the results of the study. It was concluded that the results of the study suggested that the two environments were perceived differently by teachers and functioned differently in practice; some objective evidence was obtained to indicate that student outcomes were sensitive to the two environments. (Author/EB)

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THE PSYCHOLOGICAL UNDERPINNINGS OF CURRICULA:

An Empirical Study

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The Problem

Introduction

It is obvious that the psychological position held by curriculum developers has a substantial influence on the design of programs. The differences between programs and ESS[1], MACOS and ES on the one hand and SAPA and ISCS on the other seem to a large extent a function of psychological underpinnings. The differences occur not only in terms of intended transactions and outcomes but also in the expectations held for students and assumptions made about objectives (Schulman, 1968). What is not as obvious, however, is whether these intents become realities in classrooms.

A body of literature exists suggesting changes in the schools have not occurred and where change has taken place, the process has been slow (Hoether, 1969). Surely, experience has taught us that the notion of curriculum proof teachers is more viable than teacher proof curricula. On the other hand, experience with teachers using newer programs leads one to intuitively suggest that changes are occurring in classrooms. Empirical support comes from the work of Wilson et. al. (1975) who found evidence that the philosophical profiles of teachers were a function of the program materials in use in their classroom. The difficulty is knowing whether these teachers have been influenced by the program materials they are using or whether they were different to begin with and selected them on that basis. Thus it would seem of value to establish side by side two learning environments based on programs having alternative psychological underpinnings to which teachers have been assigned at random. Whatever transactional differences occur might then be attributed to curriculum effects allowing one to respond in some way to the question, do program materials having different psychological underpinnings make a difference in the way teachers teach?

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[1] These acronyms denote the following: ESS - Elementary Science Study; MACOS - Man A Course of Study; ES-Environmental Studies; SAPA-Science A Process Approach; and ISCS - Intermediate Science Curriculum Study.

The payoff in education, however, does not lie in classroom transactions but rather in the outcomes of students. Thus the next logical step would be to assess a wide range of student outcomes and attempt to relate these to the classroom transactions that can be attributed to the curriculum materials and also to those that arise tangentially.

In the area of science teaching two positions have emerged, representing foci at opposite ends on psychological and methodological continuums. These have been described in the educational literature by Shulman (1968) who identifies the cognitive restructuring approach popularized by Bruner and the behavioral approach posited by Gagne. In the former the child is permitted freedom, allowed to make choices and encouraged to form images when presented with problems and/or materials. Such images subsequently are restructured on the basis of confrontation with additional data. The psychological position, underlying this approach, reiterated by Samples (1969) and Hawkins (1965), has influenced the development of ESS, MACOS, and ES. It would seem reasonable to suggest that the roots may extend to the Progressive Education Movement and that branches reach into the recent flurry of activity centering around open education. It is obvious to this writer that this position is not inconsistent with the work of Jones (1968) and Erickson (1963).

The behavioral approach described by Gagne (1965) is based on the identification of terminal behavior and the setting up of conditions for learners to achieve that behavior. Typically, this becomes translated into a curriculum based on behavioral objectives and a hierarchy of learning outcomes structured in a logical sequence. Ausubel, (1963) supports this position differing mainly in that he identifies a well organized content sequence as the desideratum in curriculum building. Programs such as SAPA and ISCS and work done by Scandura (1964) reflect the psychological underpinning of this approach.

Although it is speculative at this point, it would seem quite possible that the two positions being considered in this research have a direct parallel in the psychological literature dealing with the specialized functions associated with the two hemispheres of the brain (Bokan, 1969). The right cerebral hemisphere, the metaphoric-intuitive side, performs the functions associated with the intuitive, playful approach to situations. The left

hemisphere, the logical-rational side, performs functions of a more constrained organized and programmed nature. The functions involved in the former are obviously aligned closely with the cognitive restructuring approach while those of the latter are more closely related to the behavioral position. The possible link and implications of these for education have been discussed by Samples (1975).

The two psychological positions identified have been operationalized in the two programs developed for the elementary school, ESS and SAPA. The former reflects the cognitive restructuring approach and the latter the behavioral approach.

Purpose of the Study

The overall purpose of the research reported on in this paper was to study the patterns of teacher behavior and to compare student outcomes from two settings where different programs were used based on alternative psychological approaches. The specific objectives of the study were the following:

a. to identify and compare patterns of teacher behavior in classrooms employing the two types of curricula;

b. to observe the discussions and expectations of teachers during inservice sessions;

c. to compare the interests and cognitive style of students within the two curricular environments; and

d. to identify relationships that exist between patterns of teacher behavior and student outcomes.

Discussion

The study involves a comparison between two fairly global treatment conditions which involve a number of uncontrolled, intervening variables. This design was deliberate. It was felt that given the current state of the art too little is known to identify highly specific variables for purpose of comparison. Their identification and control would not be a problem; relating them to an appropriate, relevant and useful content would be. The writer's current assessment of the many studies conducted on discovery vs. expository learning was summed up by Scandura who suggested that "... more educational research should be exploratory in nature. Too much precision, too soon, is at best unrealistic and at worst misleading (1964; page 149)." This research, while comparative, is exploratory intended to identify variables

in both teacher performance and student outcomes that seem to vary under alternative conditions.

Procedures

Six teachers were randomly divided into two groups who met separately in workshops to learn the use of the ESS and SAPA materials and to become familiar with the psychological underpinnings of each. During the workshops, which were interspersed throughout the treatment period, teachers worked with the curriculum materials, reacted to reading materials reflecting the psychological position of each program, and discussed issues which arose. The treatment period consisted of a four month period in which teachers taught science using the curriculum materials reflecting the two positions. A part time research assistant was available to provide assistance for teachers in obtaining materials and also for purposes of making observations in the classrooms. A test booklet containing items designed to assess student outcomes was administered before and after the treatment by a research assistant. Attempts were made to buttress the empirical data by anecdotal observations made at all stages of the research.

Instruments

The Interest Measure

A 53 item measure of interest was administered as a pretest. Students were asked if they wished to engage in activities related to science and other subjects and responded on a three point scale, yes, no, or don't know. Based on an item analysis of the pretest the scale was broken down into two scales. The first contained 19 items describing science activities and the second scale contained 37 items describing both science and related subjects. The original form of the instrument had a reliability of .71 and the two revised scales .79 and .84 respectively.

The Process Items

A seven item multiple choice format process measure having an estimate of reliability of .73 with third to sixth grade elementary students was included in the test booklet along with two open ended problems designed to assess students' ability to make observations and inferences.

Cognitive Structure

The students were presented with a problem situation and asked to provide an explanation for the event. The first problem involved dropping

an ice cube into a graduated cylinder containing water in the bottom half and alcohol on the top. The ice cube came to rest midway down the cylinder. The second problem, administered after the treatment, involved a burning candle in a flat container partially filled with water. A clear plastic tube was lowered over the candle after which it was extinguished and water rose in the tube. The sample of responses were read and categorized in several ways until systems were found that were both manageable and conceptually reasonable. This procedure was followed only after a search of the literature revealed no appropriate means of dealing with these results.

Attempts to probe the cognitive structure of students was also attempted through analyzing the responses to the two problems described under the process measures and examining the students' responses to the question, what do you like to study in science?

Results and Discussion

Since the study reported on in this paper was the first of a series, the results must be viewed accordingly. Two other factors underline the tentative nature of the results. First, the treatment differences in the study were not monitored as effectively as the design called for. Plans for videotaping were shelved early in lieu of some reticence on the part of the teachers who preferred more experience with the materials prior to exposing themselves to video-tapes. It should be noted, however, that the monitoring done, which involved occasional visits to the classroom teachers by the investigator and research assistant, indicated that where the two programs were being used different modes of teaching were in evidence. The need to develop criterion measures resulted in a number of items in the instruments lacking precision and appropriateness, pointing up a second limitation of the study.

Because of the exploratory nature of the research, hypotheses were not generated. The results relating to each of the objectives related earlier are discussed below.

Comparisons between the behaviors exhibited by teachers in the two groups of classrooms revealed distinctions not unlike those expected. However, these comparisons were based on fairly gross observations for reasons

discussed earlier in this section. Thus, the comparison might reflect the expectations and prophetical aspirations of the research team rather than actual differences. On the basis of these very tentative observations, it would appear that the teachers' entry behavior and philosophy of teaching are highly influential factors in a study such as this and, indeed, should be measured before the experiment is begun.

The discussion and expectations of the two teachers expressed during the inservice sessions appeared substantially different. In fact a distinctive mode of thought was clearly evident in the two settings.

The differences between the two groups of students are provided in Table 1, where the means, standard deviation and F-values for the differences between the two groups are provided for five criterion variables. It can be seen that only in the case of the observation and process measures were differences evident between the two groups. In the case of the observation skills students who had been involved in the more behavioral approach to science teaching scored higher. On the process variable students in the group which involved a cognitive restructuring approach scored higher. While these results may seem contradictory, they more likely support the notion that differences for a range of criterion variables favoring one approach over the other are unlikely to occur. Rather, a profile of relative highs and lows for one or other of the treatments is a more likely probability.

The scores for the variables, observation, and inference are arrived at by counting the incidence of each from student responses in given situations. A precise scoring schedule previously established and tested was used in each case. The fact that no differences were found for the variable, inference, was partly a function, perhaps, of the low number of clear inferences made by students in the two groups.

Results not shown in Table 1 indicated a higher overall interest in science on the part of boys before and after the treatment. However, the interest of the girls increased during the treatment period while that of the boys dropped.

The study did not reveal any differences between the two treatment groups in cognitive structure on the basis of studying the responses of students to demonstrations involving changes in physical phenomena. Attempts were

Table 1

Results of the Analysis of Covariance For

Five Student Measures

Criterion Variable	Group 1 (N=84) Mean	S. D.	Group 2 (N=79) Mean	S. D.	F Value for Difference
Science Interest	51.02	7.63	51.46	7.63	.00
General Interest	84.63	10.96	84.94	11.94	.07
Observation	4.12	1.83	5.48	2.35	17.33**
Process	3.91	1.59	3.09	1.93	10.09**
Inference	1.12	.48	1.21	.66	.85

** >.01

made to classify the responses of students from different perspectives but in no case was there a system in which differences between the two treatments appeared evident. An example is provided in Table 2 where five categories were used in the classification of student responses.

Since the patterns of teacher behavior could not be ascertained objectively, no relationships between teacher behavior and student performance were made.

In conclusion, the anecdotal and observation results of the study suggested that the two environments were perceived differently by teachers and functioned differently in practice; some objective evidence was obtained to indicate that student outcomes were sensitive to the two environments. The philosophical position and teaching styles of the teachers were an important pre-condition to the experiment and in replication they should be controlled. The cognitive style of the students was not affected by the treatment which may be accounted for by the short treatment period and the inadequacy of the measures employed.

Table 2

Classification of Student Responses to Changes in Physical Phenomena

Category	Description	N. on Pretest
Description	Students describe events and occasionally predict.	13
Mechanical	The events are ascribed to something connected with the demonstration such as the jar or a special fluid. There is no apparent link or effect explained.	70
Causal #1	The action is explained by an accurate chain of events.	5
Causal #2	The action is explained by a chain of events but the concepts are inappropriate or the events inaccurate.	35
Magical	The events are explained by some broad unexplained force. Concepts such as gravity are treated as though magic.	20
Anthropomorphic	Inanimate objects caused the events.	10

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